U-Pb dating of calcite veins reveals complex stress evolution and thrust sequence in the Bighorn Basin, Wyoming, USA

Jacob O. Thacker and Karl E. Karlstrom
Department of Earth and Planetary Sciences, University of New Mexico, Albuquerque, New Mexico 87131, USA

Beaudoin et al. (2018) report precise U-Pb dates on calcite vein sets from the Bighorn arch and three anticlines in Bighorn basin (BHB). This direct dating of deformation provides an exciting avenue to unravel strain histories in intracratonic orogens. However, we summarize previously published data that conflict with the local and regional interpretations presented in their paper.

Published onset estimates for major Laramide arches in the northern foreland show an eastward sweep (Fig. 1): Blacktail-Snoverest: 90–85 Ma (Nichols et al., 1985); Madison-Gravelly: ca. 79 Ma (Kellogg and Harlan, 2007); Beartooth: 73–68 Ma (Cerveny, 1990; Peyton et al., 2012); and Black Hills: 65–60 Ma (Lisenbee and DeWitt, 1993). Basin sedimentary records support this sequence: Crazies Mountains basin 77–69 Ma (Dickinson et al., 1988), BHB 71–66 Ma (Finn, 2010), and Powder River basin 70–63 Ma (Dickinson et al., 1988). This is interpreted to represent Farallon shallowing and lithospheric hydration (Humphreys et al., 2003), and is at odds with a singular westward sequence. Furthermore, shortening along the Oregon thrust (Fig. 1) occurred during Lance Formation deposition (ca. 71–66 Ma; Finn, 2010), and stratigraphic cross sections (A-A’ and B-B’ of Finn [2010]; Fig. 1) show the Lance/Hell Creek Formation thickening toward the Beartooth front, which we interpret as flexure related to thrusting. This is 11–6 m.y. earlier than western BHB L-I vein ages (ca. 60 Ma; Beaudoin et al.’s figures 3 and 4). Recent thermochronology supports earlier exhumation for this area as well (Carrapa et al., 2019).

We view both Sevier and Laramide “stresses” to be the products of evolving convergent tectonism in the foreland. L-I vein ages of ca. 60 Ma presented by Beaudoin et al. do not record the first presence of Laramide-style strain in the western BHB. Rather, these dates may record a secondary westward sweep and/or protracted strain, either of which post-dated an initial eastward sweep that is not recorded by the U-Pb ages.

REFERENCES CITED


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